

REMARKS

Claims 1-29, 31-33, and 45-49 are pending and are rejected. Claims 19, 23, and 45 are amended. Reconsideration and allowance of Claims 1-29, 31-33, and 45-49 are respectfully requested.

Claim Rejections under 35 USC §102

Claims 1-4, 6, and 45-46 are rejected under 35 USC §102(b) as being unpatentable over "A Versatile Data String-Search VLSI," written by Masaki Hirata and published by IEEE in April 1988, (hereinafter referred to as Hirata). Applicant respectfully traverses these rejections.

Independent Claim 1

Applicant's Claim 1 recites:

A method, comprising:

receiving a text string having a plurality of characters; and

performing an unanchored search of a database of a stored patterns matching one or more characters of the text string using a state machine, wherein the state machine comprises a ternary content addressable memory (TCAM) and wherein the performing comprises comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM.

Hirata fails to disclose or suggest the method of Applicant's Claim 1.

The Office Action states that Hirata discloses "comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM, as the nonanchor search mode, the TCAM and character data stored in the CAM (Hirata: pg. 329, col. 2, Ins. 1-12; pg. 330, col. 2, Ins. 21-33)." Applicant disagrees.

Hirata discloses an architecture that "combines a content addressable memory (CAM) and a finite-state automaton logic (FSAL) to compare the input data strings with

the stored data strings.<sup>1</sup> More specifically, Hirata discloses a 2-step search process in which an input character data string (e.g., "ABC") is first compared with character strings stored in Hirata's binary CAM (e.g., "ABC," "CUSTOM," and "VLSI"), and then the comparison results of the CAM are later examined in Hirata's FSAL.<sup>2</sup> Indeed, Hirata's FIGS. 1 and 2 illustrate the CAM and the FSAL as separate components in which the results of the CAM character search operation are provided as inputs to the FSAL. For example, Hirata specifically provides:

The CAM executes a single data comparison between series input data and all the stored data in parallel... When input data and stored data match, a single data match signal is generated at the CAM output and transmitted to the FSAL... The FSAL carries out data string sequence comparison, using the single data word comparison results from the CAM.<sup>3</sup>

Thus, Hirata's CAM stores only character strings such as "ABC," "CUSTOM," and "VLSI" that are compared with an input character data string; Hirata's CAM does NOT store a state field and does NOT compare a state with the contents of the state field stored in the CAM, as recited in Applicant's Claim 1. Indeed, there is no language in Hirata that discloses or suggests using a CAM to compare states of a state machine, as recited in Claim 1. Further, Applicant notes that Hirata discloses a binary CAM, not the ternary CAM recited in Claim 1.

To anticipate a claim under 35 USC §102, each and every element of the claim must be disclosed in a single reference<sup>4</sup>. The exclusion of a claimed element from a prior art reference is typically enough to negate anticipation under 35 USC §102. Thus, because Hirata fails to disclose or suggest "comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM," as recited in Applicant's Claim 1, Claim 1 is not anticipated by Hirata. Accordingly, Applicant respectfully requests the Office to withdraw the rejection of Claim 1.

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1 Hirata, pg. 329, col. 2, lines 3-6.

2 Hirata, pg. 329, col. 2, lines 18-26.

3 Hirata, pg. 330, col. 1, lines 16-31.

4 Corning Glass Works v. Sumitomo Electric, 9 USPQ2d 1962, 1965 (Fed. Cir. 1989).

Claims 2-22 depend from Claim 1 and therefore distinguish over Hirata for at least the same reasons as Claim 1.

Independent Claim 45

Applicant's Claim 45, as amended, recites:

A string search apparatus, comprising:  
control circuitry to receive a text string having a plurality of characters; and  
a pattern and state database including a ternary content addressable memory (TCAM) coupled to an associated memory, wherein the pattern and state database is operable to perform an unanchored search of the plurality of characters with patterns stored in the TCAM and associated memory by comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, within the patterns stored in the TCAM.

As discussed above with respect to Claim 1, Hirata's CAM does NOT store a state field and does NOT compare a state with the contents of the state field stored in the CAM. Thus, Hirata fails to disclose or suggest "a pattern and state database including a ternary content addressable memory (TCAM) coupled to an associated memory, wherein the pattern and state database is operable to perform an unanchored search of the plurality of characters with patterns stored in the TCAM and associated memory by comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, within the patterns stored in the TCAM," as recited in Applicant's Claim 45. Accordingly, Claim 45 is patentable over Hirata.

Claims 46-49 depend from Claim 45 and therefore distinguish over Hirata for at least the same reasons as Claim 45.

Claim Rejections under 35 USC §103 over Hirata in view of Stellenberg

Claims 7-16, 19-21, and 31-33 are rejected as being unpatentable over Hirata in view of U.S. Patent 7,134,143 to Stellenberg et al (Stellenberg). Applicant respectfully traverses these rejections.

Claims 7-16 and 19-21

Claims 7-16 and 19-21 depend from Claim 1 and therefore distinguish over the applied references for at least the same reasons as Claim 1.

Independent Claim 31

Applicant's Claim 31 recites:

A method, comprising:

receiving a text string having a plurality of characters; and

performing a search of a database of a stored pattern matching one or more characters of the text string using a state machine, wherein the state machine comprises a ternary content addressable memory (TCAM) and wherein the performing comprises comparing a state and one of the plurality of characters with the contents of a state field and a character field, respectively, stored in the TCAM, wherein each of the plurality of characters has a case, and wherein the search is performed insensitive to the case.

Neither Hirata nor Stellenberg, whether taken alone or in combination, disclose or suggest the method of Applicant's Claim 31.

As discussed above with respect to Claim 1, Hirata's CAM does NOT store a state field and does NOT compare a state with the contents of the state field stored in the CAM. Thus, Hirata fails to disclose or suggest "comparing a state and one of the plurality of characters with the contents of a state field and a character field, respectively, stored in the TCAM," as recited in Applicant's Claim 31. Further, the Office Action has not pointed to any language in Stellenberg that discloses or suggests "comparing a state and one of the plurality of characters with the contents of a state field and a character field, respectively, stored in the TCAM," as recited in Applicant's

Claim 31. Accordingly, Claim 31 is patentable over the applied references.

Claims 32-33 depend from Claim 31 and therefore distinguish over the applied references for at least the same reasons as Claim 31.

Claim Rejections under 35 USC §103 over Hirata and Igata

Claims 5 and 49 are rejected as being unpatentable over Hirata in view of U.S. Patent 6,963,942 to Igata (Igata). Applicant respectfully traverses these rejections.

Claim 5 depends from Claim 1 and therefore distinguishes over the applied references for at least the same reasons as Claim 1.

Claim 49 depends from Claim 45 and therefore distinguishes over the applied references for at least the same reasons as Claim 45.

Claim Rejections under 35 USC §103 over Hirata, Stellenberg, and Fritchman

Claims 17-18 are rejected as being unpatentable over Hirata in view of Stellenberg and U.S. Patent 6,785,677 to Fritchman (Fritchman). Applicant respectfully traverses these rejections.

Claims 17-18 depend from Claim 1 and therefore distinguishes over the applied references for at least the same reasons as Claim 1.

Claim Rejections under 35 USC §103 over Hirata, Stellenberg, and McAuley

Claim 22 is rejected as being unpatentable over Hirata in view of Stellenberg and "Fast Routing Table Look-up using CAMs," written by Anthony J. McAuley and published by IEEE in 1993 (McAuley). Applicant respectfully traverses this rejection.

Claim 22 depends from Claim 1 and therefore distinguishes over the applied references for at least the same reasons as Claim 1.

Claim Rejections under 35 USC §103 over Hirata and Fritchman

Claims 23-29 are rejected as being unpatentable over Hirata in view of Fritchman. Applicant respectfully traverses these rejections.

Applicant's Claim 23, as amended, recites:

A method, comprising:

receiving a text string having a plurality of characters including a first number of prefix characters, a second number of wildcard characters succeeding the prefix characters, and a third number of suffix characters succeeding the wildcard characters;

performing a first search on a ternary content addressable memory (TCAM) for a first stored pattern matching the prefix characters, wherein the first pattern stored in the TCAM includes state information indicative of a state machine and includes character information indicative of the first pattern; and

performing a second search of the TCAM for a second stored pattern matching the suffix characters, wherein the second pattern stored in the TCAM includes state information indicative of the state machine and includes character information indicative of the second pattern.

Neither Hirata nor Fritchman, whether taken alone or in combination, disclose or suggest the method of Applicant's Claim 23.

As discussed above with respect to Claim 1, Hirata's CAM does NOT store a state field and does NOT compare a state with the contents of the state field stored in the CAM. Thus, Hirata fails to disclose or suggest "performing a first search on a ternary content addressable memory (TCAM) for a first stored pattern matching the prefix characters, wherein the first pattern stored in the TCAM includes state information indicative of a state machine and includes character information indicative of the first pattern" and "performing a second search of the TCAM for a second stored pattern matching the suffix characters, wherein the second pattern stored in the TCAM includes state information indicative of the state machine and includes character information indicative of the second pattern," as recited in Claim 23. Further, the Office Action has not pointed to any language in Fritchman that discloses or suggests storing state information in a ternary CAM, as recited in Applicant's Claim 23. Accordingly, Claim 23 is patentable over the applied references.

Claims 24-29 depend from Claim 23 and therefore distinguish over the applied references for at least the same reasons as Claim 23.

Claim Rejections under 35 USC §103 over Hirata and other references

Claims 47-48 are rejected as being unpatentable over Hirata in view of various other applied references. Applicant respectfully traverses these rejections.

Claims 47-48 depend from Claim 45 and therefore distinguish over the applied references for at least the same reasons as Claim 45.

CONCLUSION

In light of the above remarks, it is believed that Claims 1-29, 31-33, and 45-49 are allowable, and therefore a Notice of Allowance of Claims 1-29, 31-33, and 45-49 is respectfully requested. If the Examiner's next action is other than allowance as requested, the Examiner is requested to call the undersigned at (408) 236-6646.

Respectfully submitted,



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